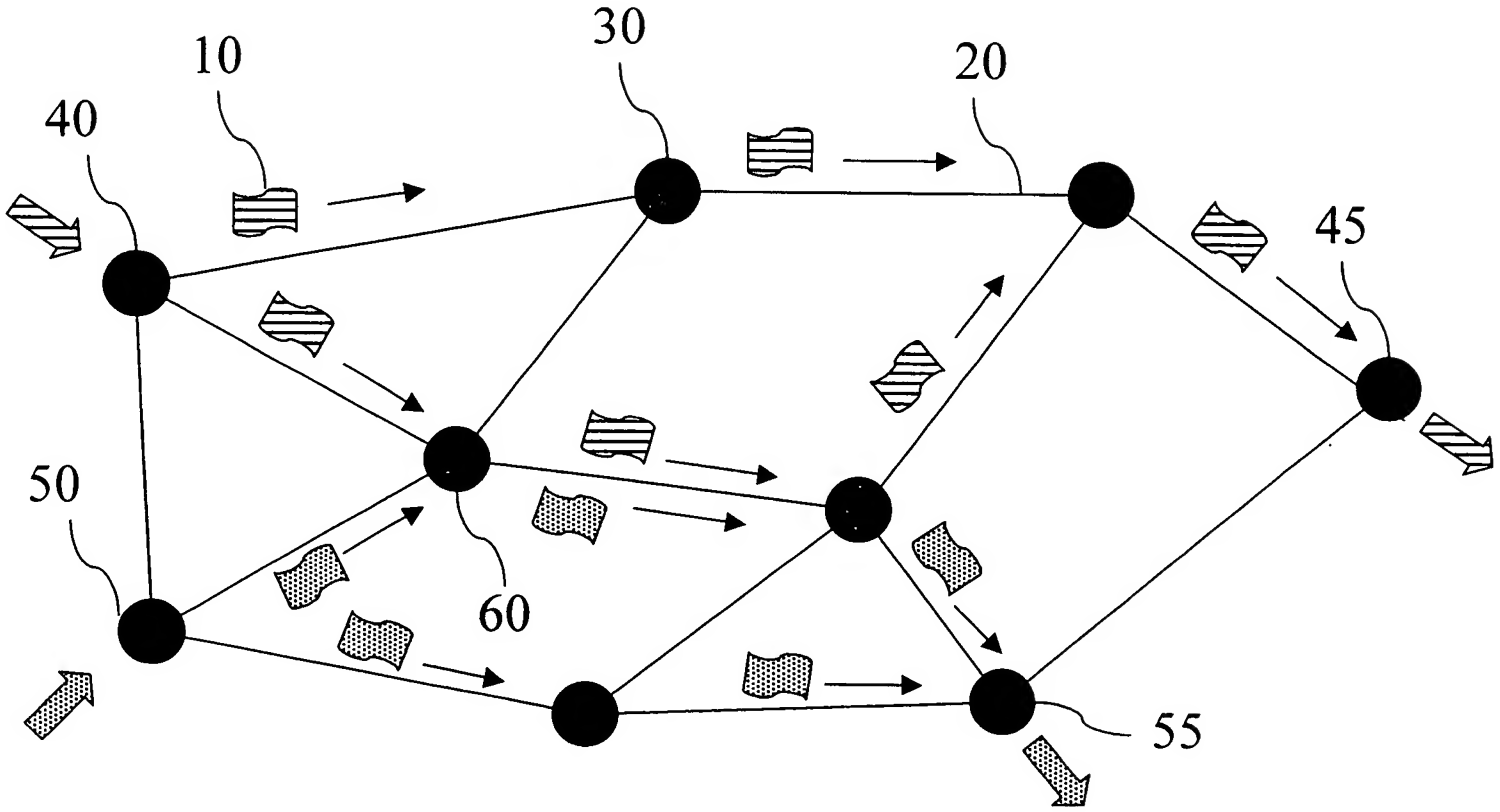


FIG. 1 (Prior Art)

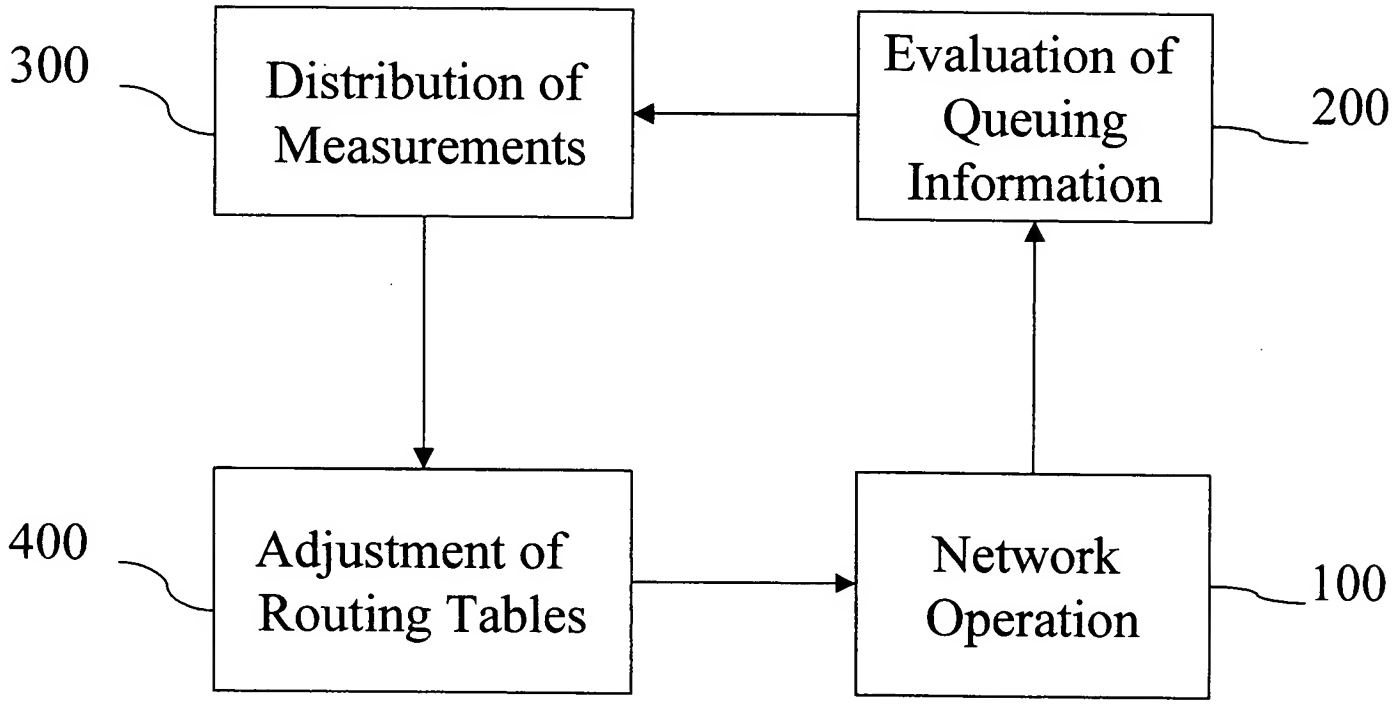

300
Distribution of Measurements
Evaluation of Queuing Information
200
400
Adjustment of Routing Tables
Network Operation
100

FIG. 2

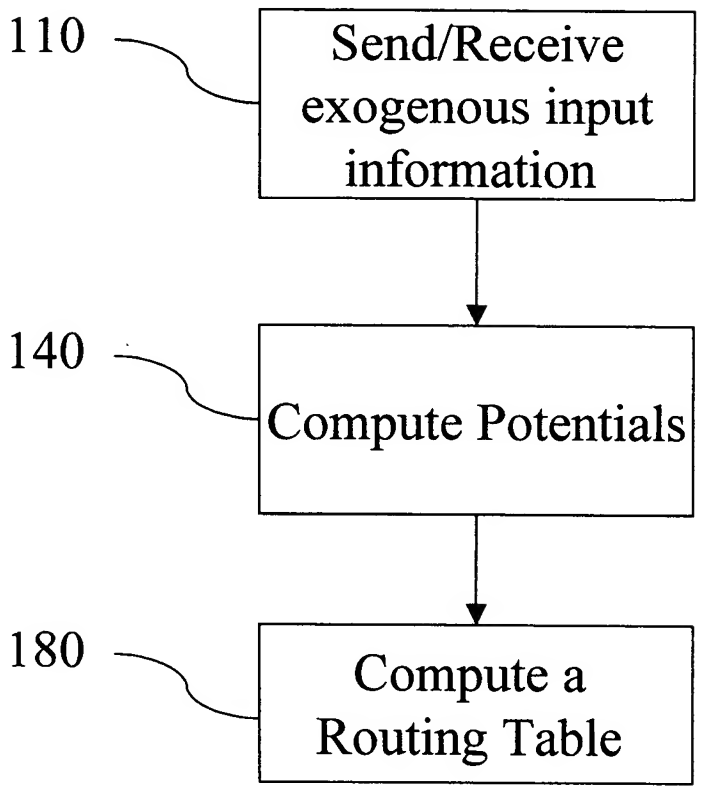

110
Send/Receive exogenous input information
140
Compute Potentials
180
Compute a Routing Table

FIG. 3

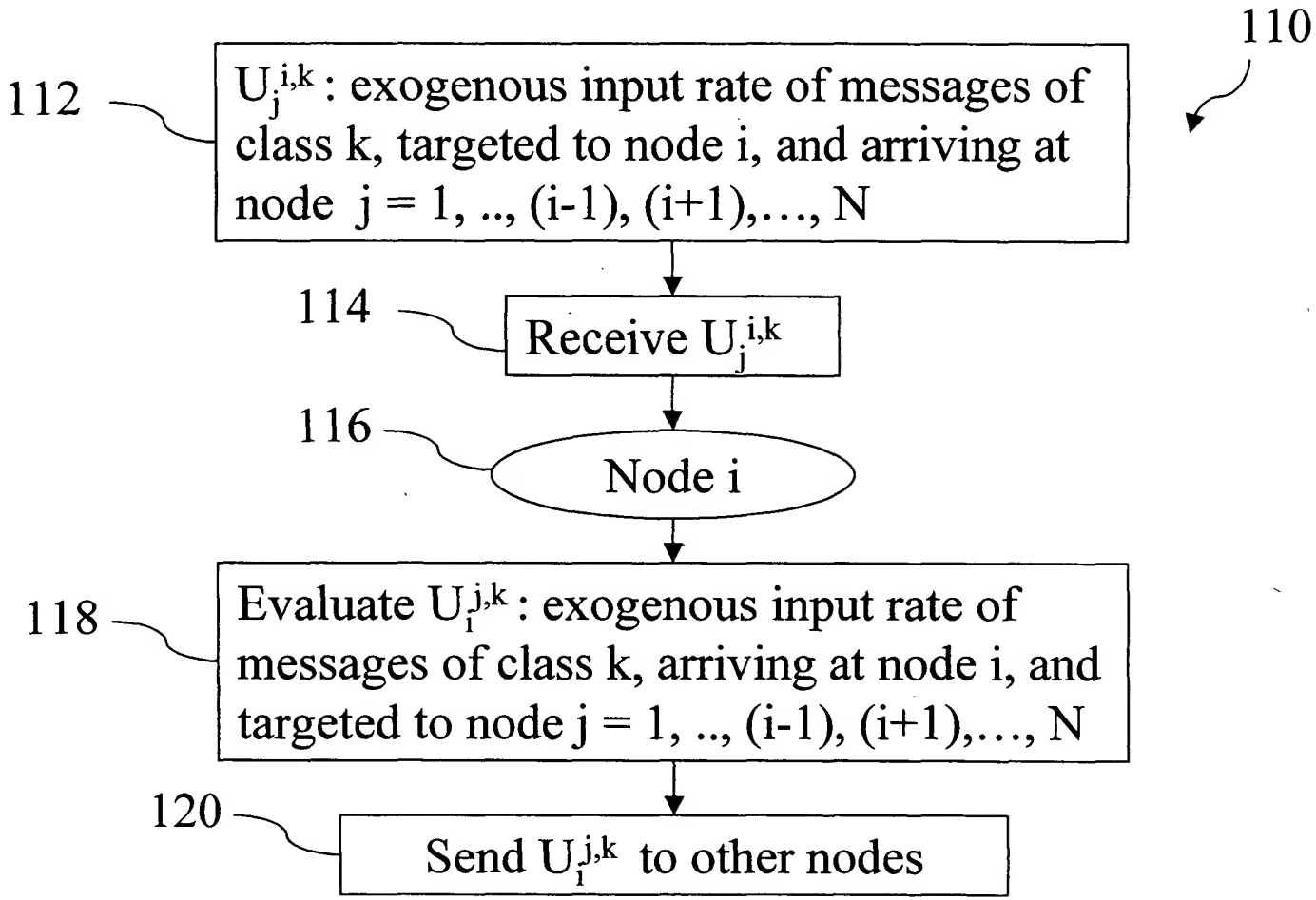
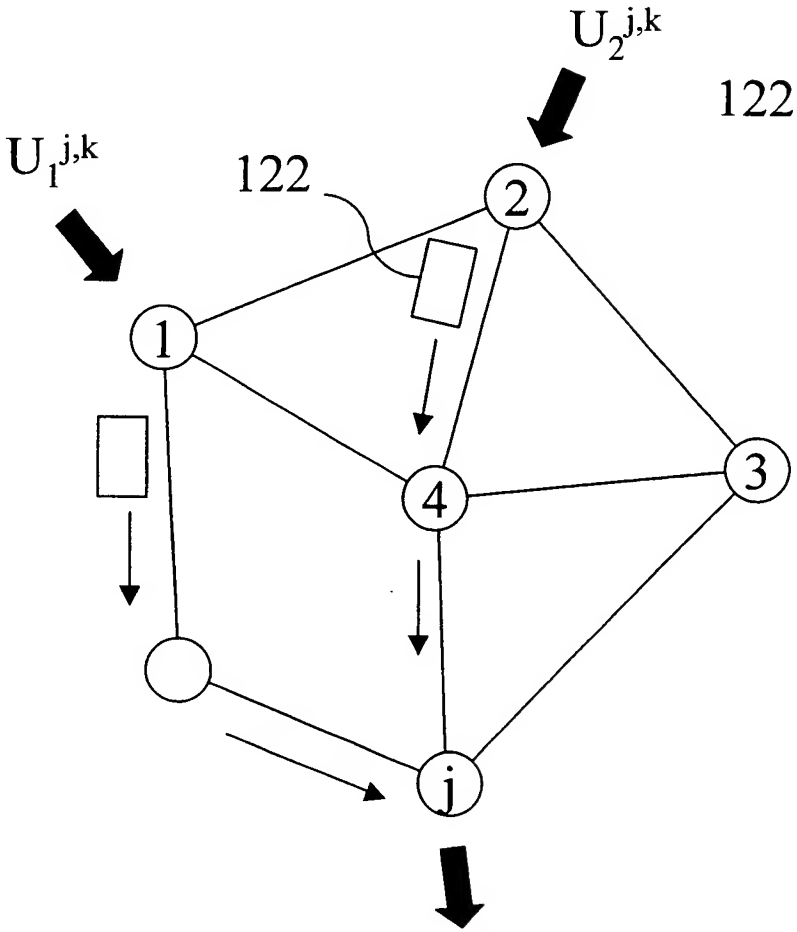
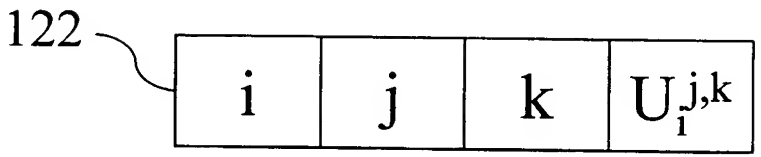

110
112
$U_j^{i,k}$: exogenous input rate of messages of class k, targeted to node i, and arriving at node j = 1, .., (i-1), (i+1),…, N
114
Receive $U_j^{i,k}$
116
Node i
118
Evaluate $U_i^{j,k}$: exogenous input rate of messages of class k, arriving at node i, and targeted to node j = 1, .., (i-1), (i+1),…, N
120
Send $U_i^{j,k}$ to other nodes

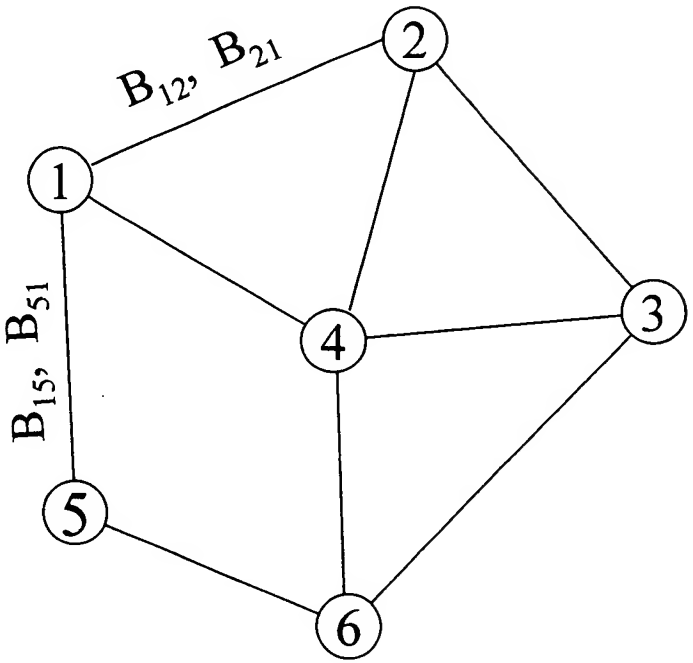
FIG. 4





A control frame carrying $U_i^{j,k}$ are sent (or broadcast/multicast) from the source nodes to the target node j

FIG. 5



N(1) = {2, 4, 5}

N(2) = {1, 3, 4}

N(3) = {2, 4, 6}

N(4) = {1, 2, 3, 6}

N(5) = {1, 6}

N(6) = {3, 4, 5}

FIG. 6

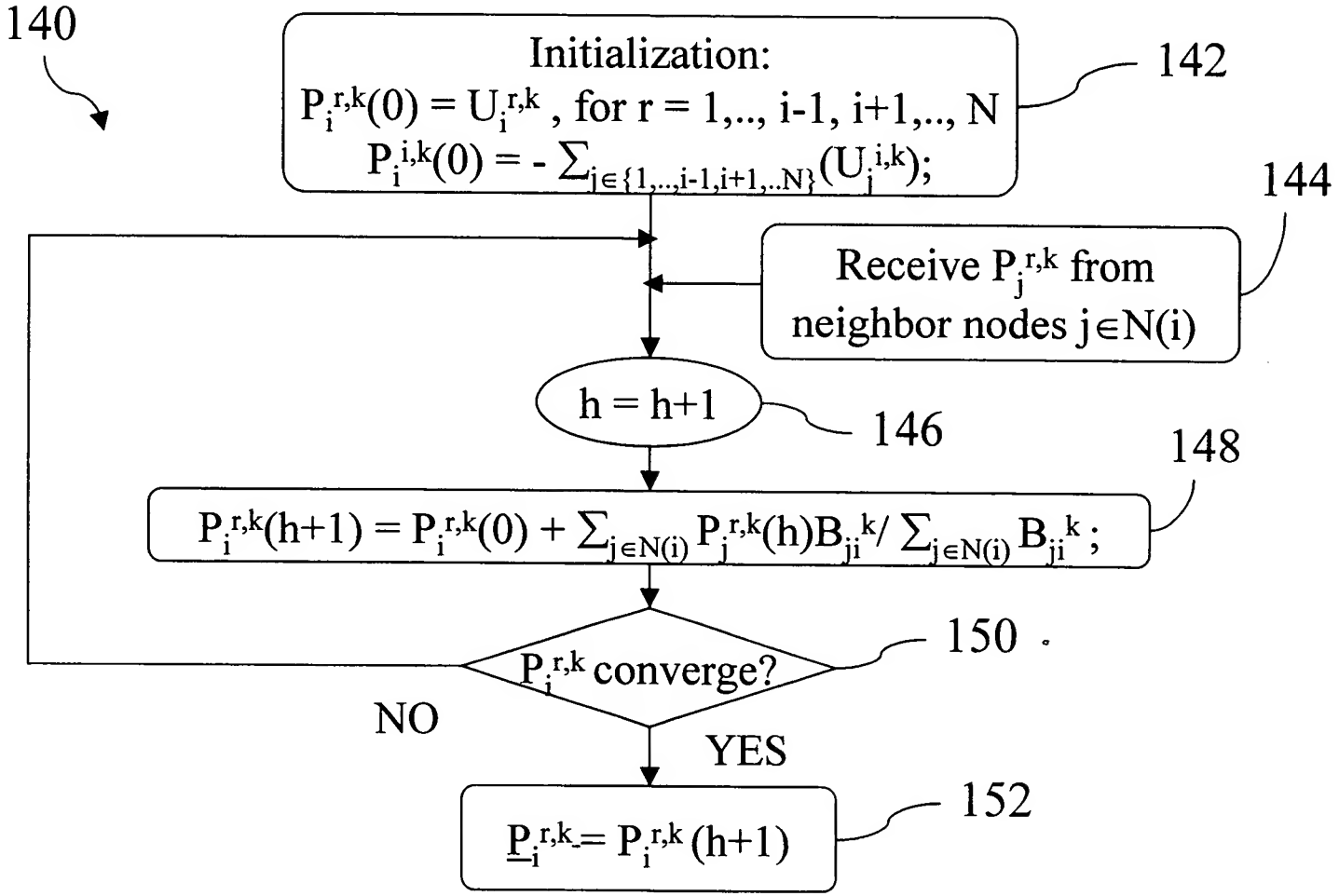
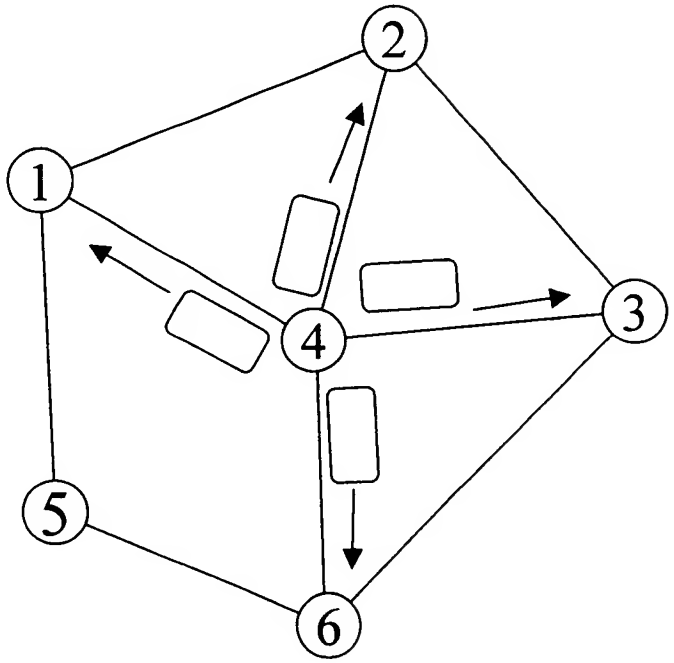
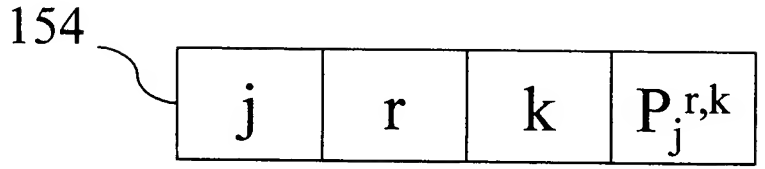

140
Initialization:
$P_i^{r,k}(0) = U_i^{r,k}$, for r = 1,.., i-1, i+1,.., N
$P_i^{i,k}(0) = -\sum_{j\in\{1,..,i-1,i+1,..N\}}(U_j^{i,k})$;
142
144
Receive $P_j^{r,k}$ from neighbor nodes $j\in N(i)$
h = h+1
146
148
$P_i^{r,k}(h+1) = P_i^{r,k}(0) + \sum_{j\in N(i)} P_j^{r,k}(h)B_{ji}^k / \sum_{j\in N(i)} B_{ji}^k$;
$P_i^{r,k}$ converge?
150
NO
YES
$\underline{P}_i^{r,k} = P_i^{r,k}(h+1)$
152

FIG. 7





Control frames carrying $P_j^{r,k}$ are sent from the neighbor node j to node i

FIG. 8

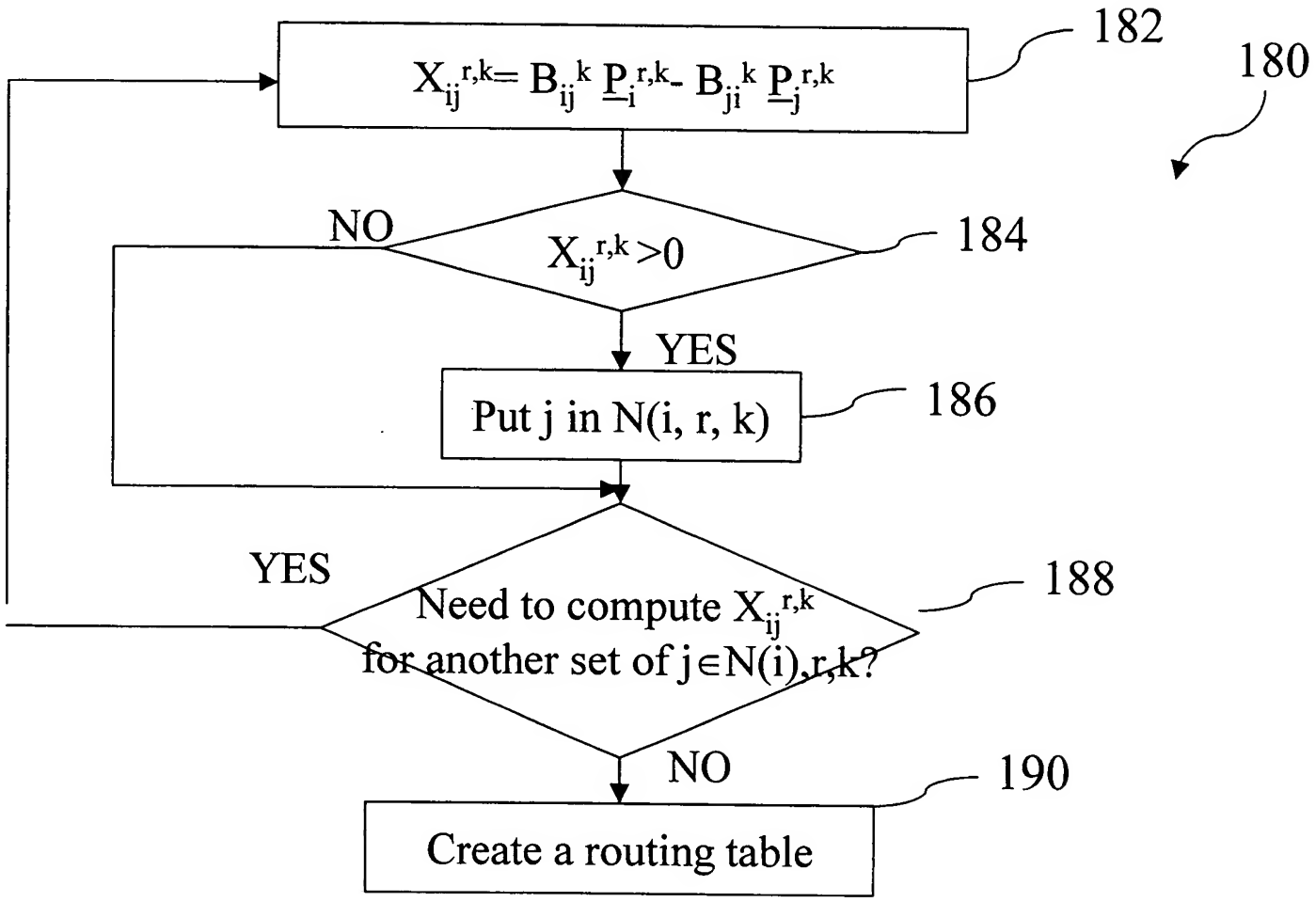

$X_{ij}^{r,k} = B_{ij}^{k} \underline{P}_i^{r,k} - B_{ji}^{k} \underline{P}_j^{r,k}$
182
180
NO
$X_{ij}^{r,k} > 0$
184
YES
Put j in N(i, r, k)
186
YES
Need to compute $X_{ij}^{r,k}$ for another set of $j \in N(i),r,k$?
188
NO
190
Create a routing table

FIG. 9

Routing Table at Node i

Target node address	Next node address	Percentage of flow rate
r1	$j1 \in N(i,r1,1)$	$X_{i,j1}^{r1,1} / \sum_{j \in N(i,r1,1)} X_{i,j}^{r1,1}$
r1	:	:
r1	$jn \in N(i,r1,1)$	$X_{i,jn}^{r1,1} / \sum_{j \in N(i,r1,1)} X_{i,j}^{r1,1}$
:	:	:
r2	$k1 \in N(i,r2,1)$	$X_{i,k1}^{r2,1} / \sum_{k \in N(i,r2,1)} X_{i,k}^{r2,1}$
:	:	:

FIG. 10

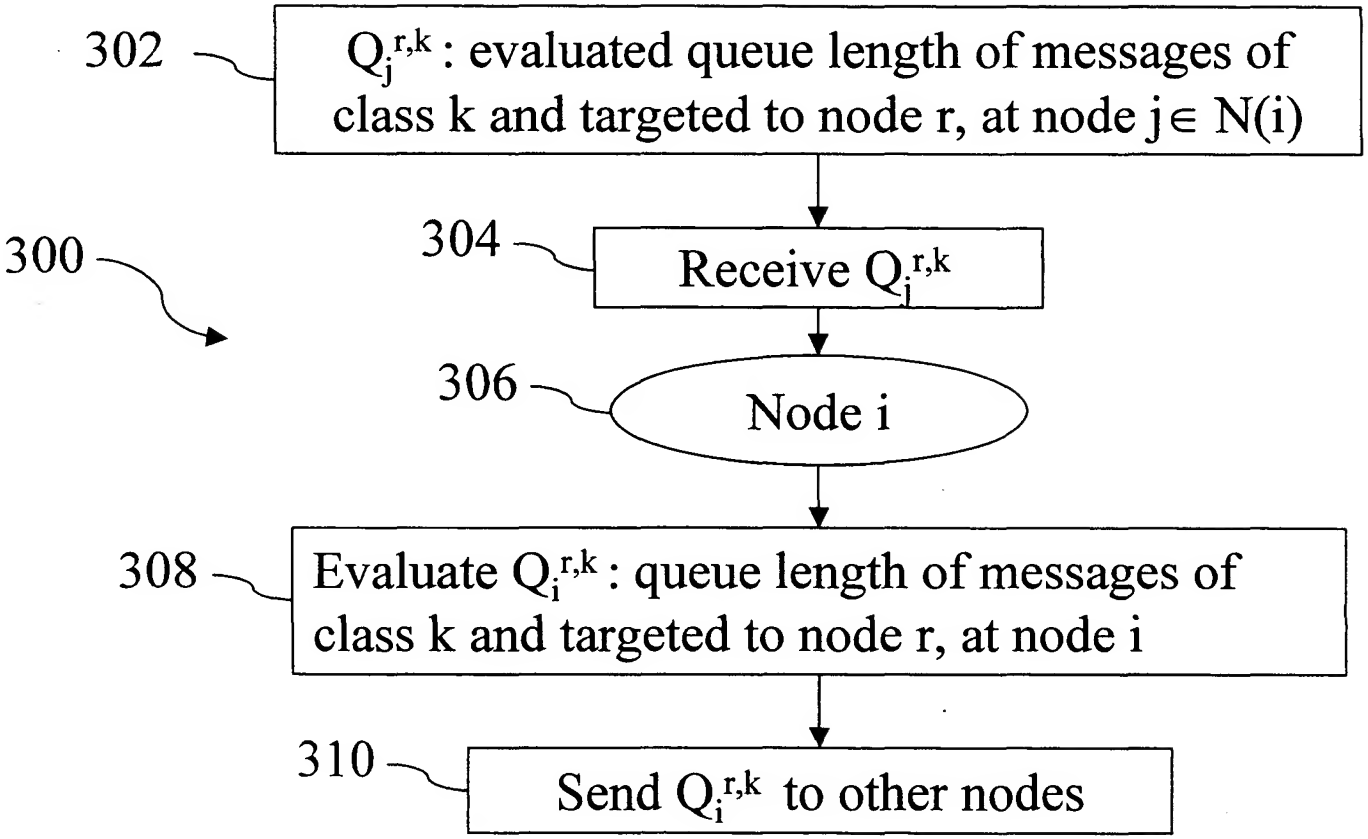
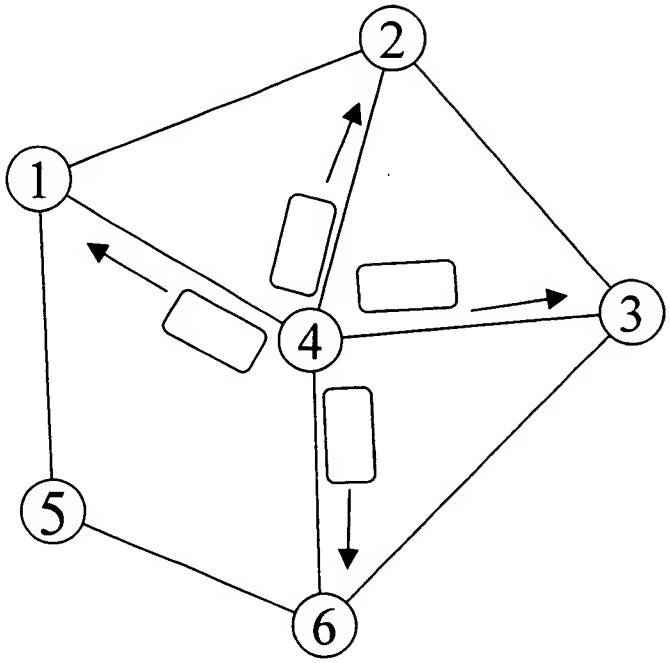
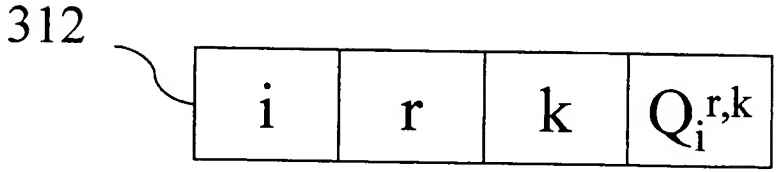

302
$Q_j^{r,k}$: evaluated queue length of messages of class k and targeted to node r, at node j∈ N(i)
300
304
Receive $Q_j^{r,k}$
306
Node i
308
Evaluate $Q_i^{r,k}$: queue length of messages of class k and targeted to node r, at node i
310
Send $Q_i^{r,k}$ to other nodes

FIG. 11





Control frames carrying $Q_i^{r,k}$ are sent from node i to its neighbor nodes

FIG. 12

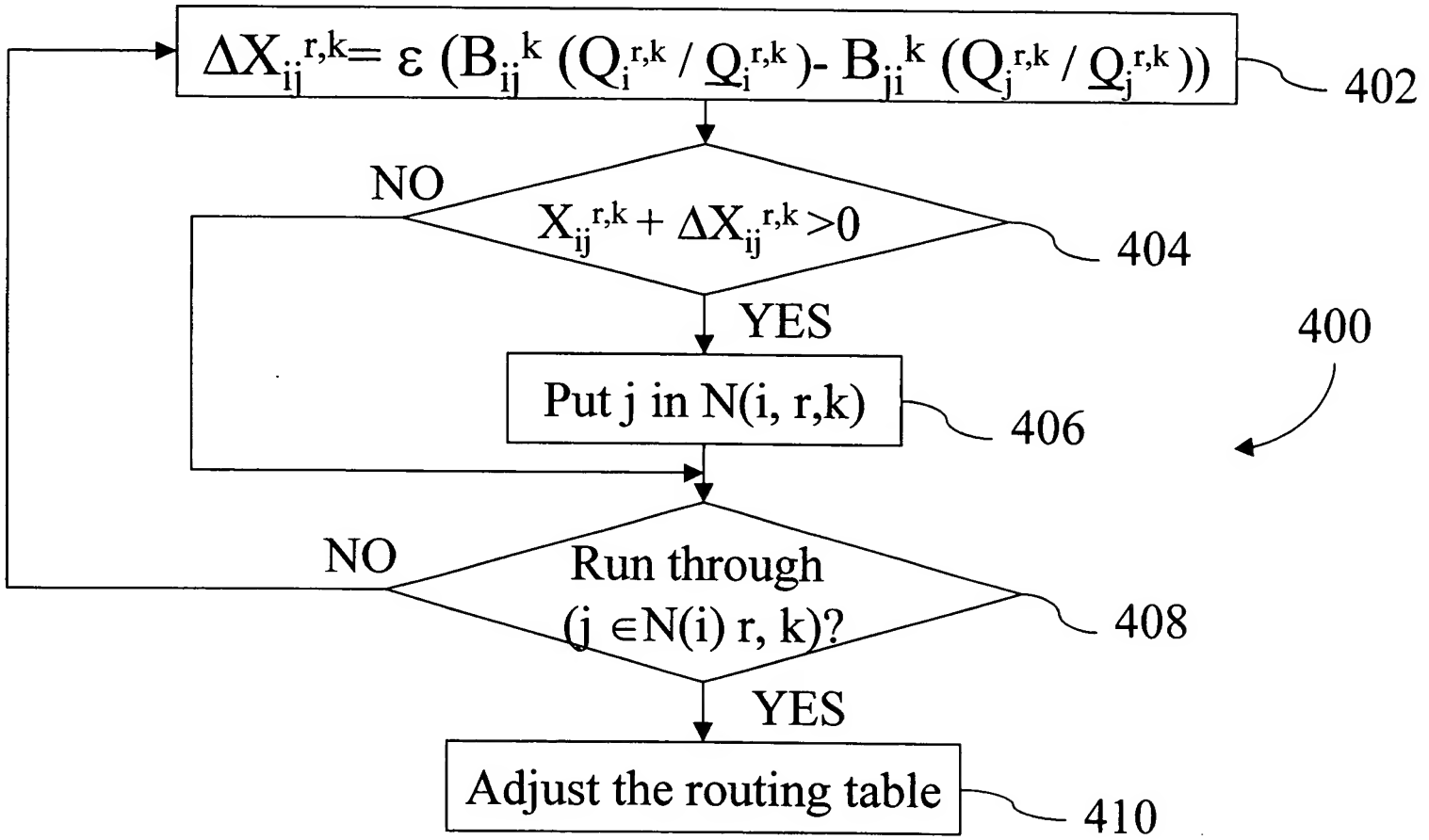

$\Delta X_{ij}^{r,k} = \varepsilon (B_{ij}^{k} (Q_i^{r,k} / \underline{Q}_i^{r,k}) - B_{ji}^{k} (Q_j^{r,k} / \underline{Q}_j^{r,k}))$
402
NO
$X_{ij}^{r,k} + \Delta X_{ij}^{r,k} > 0$
404
YES
400
Put j in N(i, r,k)
406
NO
Run through
(j ∈N(i) r, k)?
408
YES
Adjust the routing table
410

FIG. 13

Routing Table at Node i

Target node address	Next node address	Percentage of flow rate
r1	j1 $\in N(i,r1,1)$	$(X_{i,j1}^{r1,1} + \Delta X_{i,j1}^{r1,1}) / \sum_{j \in N(i,r1,1)} (X_{i,j}^{r1,1} + \Delta X_{i,j}^{r1,1})$
r1	:	:
r1	jn $\in N(i,r1,1)$	$(X_{i,jn}^{r1,1} + \Delta X_{i,jn}^{r1,1}) / \sum_{j \in N(i,r1,1)} (X_{i,j}^{r1,1} + \Delta X_{i,j}^{r1,1})$
:	:	:
r2	k1 $\in N(i,r2,1)$	$(X_{i,k1}^{r2,1} + \Delta X_{i,k1}^{r2,1}) / \sum_{k \in N(i,r2,1)} (X_{i,k}^{r2,1} + \Delta X_{i,k}^{r2,1})$
:	:	:

FIG. 14